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ENGINEERING EVALUATION AND COST ANALYSIS FOR THE FORMER USS WASHTENAW COUNTY (LST-1166)

REVISION 1

Submitted to:

U.S. Environmental Protection Agency
Region 10
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EPA Task Order No.	**001**
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EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) Report addresses the former USS Washtenaw County, a 2,590-ton *LST-1166* class tank landing ship (hereinafter referred to as LST-1166), which is currently located in the Columbia River near Dibblee Point, Columbia County, Oregon.

The United States Coast Guard (USCG) has tasked the United States Environmental Protection Agency (EPA), under a Pollution Removal Funding Authorization (PRFA) dated 2 September 2010, with preparation of the EE/CA Report for LST-1166. The EPA has subsequently contracted TechLaw, Inc. (TechLaw) under Contract Number EP-S7-06-03 and Technical Direction Document (TDD) 10-12-0040 to assist with the preparation of this EE/CA Report.

This EE/CA Report has been completed as required by 40 Code of Federal Regulations (CFR) 300.415(b)(4) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and was prepared using *Guidance on Conducting Non-Time Critical Removal Actions under CERCLA*, EPA/540-R-93-057, dated August 1993 (EPA 1993).

LST-1166 is currently located at Dibblee Point along the south bank of the Columbia River, south of Lord Island at River Mile No. 63 (Figure 1). It is located approximately 4.5 miles west-northwest of Rainier, Oregon and approximately 1.25 miles downstream and south of Longview, Washington. LST-1166 is located in the DELENA United States Geologic Service (USGS) topographic map quadrangle at 46° 7'17.82" N 123° 0'52.24"W.

The vessel is currently owned by Washtenaw County LST-1166, LLC a defunct non-profit organization. The current owner originally purchased the vessel with the intent of converting it to a maritime museum. In 2002, the vessel was towed to its current location and some refurbishing was conducted; however, conversion to a maritime museum was not successful.

On May 29, 2003 Washtenaw County LST-1166, LLC formerly doing business as Amphibious Forces Memorial Museum (AFMM) purchased the vessel. The company was administratively dissolved on August 4, 2006, and then reinstated on September 24, 2007. The USCG Sector Portland has issued three Administrative Orders and a Captain of the Port (COTP) order to the owners for environmental cleanup and mitigation of the potential threats from the vessel, but the owner has not complied. Furthermore, the Certificate of Financial Responsibility (COFR) Guarantor for the vessel, Lloyd's of London, cancelled the COFR as of February 7, 2008.

The USCG plans to eliminate access to LST-1166 due to unacceptable exposure risks to human and ecological receptors from contamination which remains on LST-1166 including polychlorinated biphenyls (PCBs) in interior paint exceeding 50 parts per million (ppm),

asbestos containing material (ACM), friable paint containing lead, and wiring insulation containing polychlorinated biphenyls (PCBs). Most of the easily accessible wiring in the vessel has been removed by scavengers for the recyclable copper content. The electrical wiring that remains (approximately 60 pounds remain on board) contains concentrations of PCB that range from <0.50 milligrams per kilogram (mg/kg) to 2,160 ppm.

The LST-1166 is within the USCG's Area of Responsibility (AOR) for which it is the lead agency for response incidents under the NCP and the Area Contingency Plan (ACP). This includes spill responses and removal actions conducted pursuant to the federal Clean Water Act (CWA) as amended by the Oil Pollution Act of 1990 (OPA), and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Due to the presence of elevated levels of PCBs onboard the vessel, disposal of PCBs on the LST-1166 in the ocean is also covered by the Toxic Substances Control Act (TSCA).

The goal of the EE/CA is to effectively address the human health and ecological risks identified within the streamlined risk evaluation. The scope corresponds to the following removal factors identified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP):

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;
- The availability of other appropriate federal or state response mechanisms to respond to the release; and
- Other situations or factors that may pose threats to public health or welfare of the United States or the environment.

The Site characterization information, and identification and analyses of the removal action alternatives presented in this EE/CA are based on the findings and investigations conducted by USCG and EPA and information obtained from various sources.

To address the removal action objectives and scope, a limited number of alternatives were assembled from applicable technologies and options. The technologies and options considered include: Decontamination, Recycling, Treatment and Disposal.

Three removal alternatives were assembled and analyzed.

Alternative 1: Ocean Disposal with Limited Decontamination

Alternative 2: Ocean Disposal with Full Decontamination

Alternative 3: Decontamination, Dismantling and Recycle/Disposal

The alternatives were subsequently evaluated with respect to implementability, effectiveness and cost. Based on the findings of the individual and comparative analyses, Alternative 3 is the recommended removal action.

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ENGINEERING EVALUATION AND COST ANALYSIS
FOR THE FORMER USS WASHTENAW COUNTY (LST-1166)

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ABBREVIATIONS AND ACRONYMS

ACM	Asbestos Containing Material
ACP	Area Contingency Plan
AFMM	Amphibious Forces Memorial Museum
AOR	Area of Responsibility
ARAR	Applicable or Relevant and Appropriate Requirements
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COFR	Certificate of Financial Responsibility
COPC	Constituents of Potential Concerns
COTP	Captain of the Port
CWA	Clean Water Act
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
F	Fahrenheit
GIS	Geographic Information System
mcy	million cubic yards
mcy/yr	million cubic yards per year
mph	miles per hour
mg/kg	milligram per kilogram
mg/L	milligram per liter
mm	millimeter
MPRSA	Marine Protection Research and Sanctuaries Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NTCRA	Non-Time Critical Removal Action
O&M	Operation & Maintenance
ODGP	Ocean Dumping General Permit
OPA	Oil Pollution Act
OSLTF	Oil Spill Liability Trust Fund
PCB	polychlorinated biphenyl
PEO	Program Executive Office
PPE	Personal Protective Equipment
ppm	parts per million
PRFA	Pollution Removal Funding Authorization
PRSC	Post Removal Site Control
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
TBC	To Be Considered
TSD	Treatment, Storage and Disposal
TDD	Technical Direction Document
TSCA	Toxic Substances Control Act
µg/L	microgram per liter
µg/ft^2	microgram per square foot

USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOJ	United States Department of Justice
USGS	United States Geologic Service

1.0 SITE CHARACTERIZATION

This section of the Engineering Evaluation/Cost Analysis (EE/CA) presents general information regarding the vessel including the location, operations and history of the vessel. The environmental setting of the area is described along with the adjacent land use, population near the site, meteorology, and sensitive ecosystems. Previous response actions that have been conducted are also described. Information related to source, nature and extent of contamination associated with the vessel are provided.

1.1 Site Description and Background

Site description including description of the vessel location, the Columbia River, topography, land use and climate are discussed below.

1.1.1 Vessel Location

LST-1166 is currently located at Dibblee Point along the south bank of the Columbia River, south of Lord Island at River Mile No. 63 (Figure 1). It is located approximately 4.5 miles west-northwest of Rainier, Oregon and approximately 1.25 miles downstream and south of Longview, Washington. LST-1166 is located in the DELENA United States Geologic Service (USGS) topographic map quadrangle at 46° 7'17.82" N 123° 0'52.24" W.

Columbia River

The Columbia River navigation channel begins at the Columbia River bar and continues five miles upriver at a depth of 55 feet and a width of 2,640 feet. After which, it maintains a depth of 43 feet and a width of 600 feet for 100 miles to the Portland Harbor. The Barlow Channel, which runs adjacent to the LST-1166, has an approximate depth of 40-43 feet (NOAA *undated*).

1.1.2 Vessel History

LST-1166 was built in Sturgeon Bay, Wisconsin. It was commissioned in late October 1953 and served in the western Atlantic and Caribbean areas for two years. At the beginning of July 1955 the ship was renamed the *Washtenaw County*. From January to May of 1956 the ship served in the Mediterranean Sea as a unit of the Sixth Fleet and in mid-January 1958 passed through the Panama Canal to join the Pacific Fleet. *Washtenaw County*'s first regular Western Pacific cruise began in April 1959 and was completed in September.

Washtenaw County spent the next thirteen years participating in Seventh Fleet amphibious training and logistics activities (Photograph 1). Beginning in mid-1964 the Washtenaw County was involved in Vietnam War operations. The last of *Washtenaw County*'s wartime assignments ended in mid-1972. In 1973 the ship underwent conversion to a special minesweeper and in

February 1973 was decommissioned. *Washtenaw County* was inactivated at Yokosuka, Japan, in August 1973. The ship was stricken from the Naval Vessel Register late in August 1973 and was sold at the end of January 1975 (Naval History and Heritage Command 2006).

LST-1166 was subsequently purchased by foreign interests. It was registered commercially as Al Manhal I from 1973 to 1980 and as El CentroAmericano from 1980 to 1984. In 1980, LST-1166 was towed to Astoria, Oregon because of mechanical issues, and it has been moored at various locations along both the Willamette and Columbia rivers. In 2002, the owner of the LST-1166 was granted temporary permission to moor at Dibblee Point, approximately 1.25 miles south of Longview, Washington (USCG 2009).

The vessel is currently owned by Washtenaw County LST-1166, LLC a defunct non-profit organization. The current owner originally purchased the vessel with the intent of converting it to a maritime museum. In 2002, the vessel was towed to its current location and some refurbishing was conducted; however, conversion to a maritime museum was not successful.

On May 29, 2003 Washtenaw County LST-1166, LLC formerly doing business as Amphibious Forces Memorial Museum (AFMM) purchased the vessel. The company was administratively dissolved on August 4, 2006, and then reinstated on September 24, 2007. The USCG Sector Portland has issued three Administrative Orders and a Captain of the Port (COTP) order to the owners for environmental cleanup and mitigation of the potential threats from the vessel, but the owner has not complied. Furthermore, the Certificate of Financial Responsibility (COFR) Guarantor for the vessel, Lloyd's of London, cancelled the COFR as of February 7, 2008. They have refused to conduct a cleanup of the vessel. The current owner, Washtenaw County LST-1166, LLC is, for all intents and purposes, financially defunct.

Trespassing appears to have begun in 2004. Reports of vandalism, illegal methamphetamine activity, illegal dumping of waste oil and stripping and theft of metal, wiring, piping, hatches and valves have since occurred (EPA 2010b).

The LST-1166 hull has deteriorated and the vessel has taken on water from an apparent leak. The bottom two decks and the engine room are currently flooded (EPA 2010b).

1.1.3 Surrounding Land Use and Populations

LST-1166 is currently located at Dibblee Point along the south bank of the Columbia River, south of Lord Island at River Mile No. 63. Dibblee Point is a 110-acre parcel located just outside the city limits of Rainier, Oregon and is owned by the State of Oregon and managed by the Division of State Lands. Columbia County owns a small parcel of land within the 110 acres and

approximately 60 acres is leased by a local sand quarry operation, BC Excavation (no author 2003).

LST-1166 is moored to the bank south of the vessel. This shoreline contains forested river banks, wetlands and open farmlands. Several farms are located within one mile of the vessel with the closest farm within 1/4-mile. Lord Island, located north of LST-1166, primarily consists of wetland and forested land. LST-1166 is bordered east and west by the Columbia River (EPA 2010b).

LST-1166 is located in a semi-remote part of the river; however, this area is extensively used by the public for fishing and it is downstream from a public access beach. The land immediately adjacent to the LST-1166 is used both recreationally and for industrial purposes (EPA 2010).

The closest city to LST-1166 is Longview, Washington in Cowlitz County which has a population of approximately 36,767 (USCB 2006). Drinking water sources for this community include private wells and public water systems, and are tracked by area by the Division of Environmental Health Office of Drinking Water.

1.1.4 Sensitive Ecosystems

The Columbia River supports a wide array of fish, wildlife and sensitive environments. No officially designated wilderness areas or wildlife preserves are located in the vicinity of the vessel; however, several species have been listed as endangered for Columbia County and may be found in the vicinity of the site (EDR 2011).

The upper, middle, and lower Columbia River populations of Steelhead (*Oncorhynchus mykiss)*; the upper and lower Columbia River populations of Chinook salmon (*Oncorhynchus tshawytscha)*; and, the Columbia River population of Chum salmon (*Oncorhynchus keta)* have been federally-listed as endangered species (EDR 2011). On the state-level, the river has been designated as critical habitat for Bull Trout (*Salvelinus confluentus*) and Steelhead (*Oncorhynchus mykiss)*, and is a migratory pathway crucial for the maintenance of Steelhead (*Oncorhynchus mykiss)* (WA DEP 2003). In addition, the Northern Spotted owl (*Strix occidentalis caurina*), Bald eagle (*Haliaeetus leucocephalus)*, and Columbian White-tailed deer (*Odocoileus virginianus leucurus*) have been federally-listed as endangered species for Columbia County (EDR 2011).

Lord Island, located north of LST-1166, is designated as a waterfowl use area and wetland habitat (WA DEP 2003). Both Riverine and Palustrine wetland systems are located in the vicinity of the vessel (EDR 2011).

1.1.5 Meteorology

The average temperature for the area ranges from 45 degrees Fahrenheit (°F) in the winter months to 76°F in the summer months with an annual average precipitation of 46.17". Wind conditions are generally less than 15 miles per hour (mph) with gusts to 20 mph. (NOAA *undated*).

1.2 Previous Removal Actions and Investigations

1.2.1 United States Coast Guard

On September 7, 2007, the United States Coast Guard (USCG) was notified by local law enforcement authorities that oil was discharging from the LST-1166 into the Columbia River. The USCG immediately conducted an inspection of the ship and confirmed there was a substantial threat of discharge of fuel oil and hazardous substances, due to the deteriorated condition of the vessel. Further investigation revealed that the cause of the sheen was a result of thieves stripping the piping, valves, wire, and hydraulic lines. The evidence of vandalism and theft was documented during this inspection. During the investigation, the USCG discovered lubricants, solvents, potential asbestos-containing materials (ACM), and lead-based paint on and in the vessel.

On November 13, 2007, the USCG issued an Administrative Order (Order) to the vessel owner, USS Washtenaw County – LST1166, LLC, to remove all contaminants from the vessel. The owner held a COFR, which was issued because the vessel operator had demonstrated their ability to pay for cleanup and damage costs in the event of a water pollution incident under the Oil Pollution Act (OPA). The COFR was underwritten by Lloyds of London, who hired a contractor to respond to the Order.

On January 15, 2008, the USCG, pursuant to 40 Code of Federal Regulations (CFR) 229.3 for vessel disposal under the Marine Protection, Research and Sanctuaries Act (MPRSA), gave the owner 30 days to submit a comprehensive plan. On February 1, 2008, Region 10's Ocean Dumping program receives a request from the underwriter's contractor seeking authorization to use the United States Environmental Protection Agency (EPA) Ocean Dumping General Permit (ODGP) to dispose of the LST-1166 at sea. However, on February 15, 2008, the contractor was denied permission because the terms of the GP had not been met - the contaminants on the vessel had not been removed to the maximum extent practicable, as required. Following dissolution of LLC, the underwriters discontinued efforts to comply with the USCG orders.

USCG, in response to the owner's non-compliance with the Order, conducted interim removal activities from July 2008 to January 2009. The materials removed and disposed of during the Removal Action are summarized in Table 1.2.1.

Table 1.2.1: Removal Action Disposal Summary

Total	Unit	Material Description	Disposal Facility
3,975	Gallons	fuel and oil	ORRCO (Oil Re-refining Co.) Portland, OR
8,100	Pounds	oily debris	Hillsboro Landfill Hillsboro, OR
26,342	Gallons	oily water	ORCCO (Oil Re-refining Co.) Portland, OR
465,800	Gallons	Carbon filter media used for treatment of water from lower decks.	Hillsboro Landfill Hillsboro, OR
5,125	Gallons	polychlorinated biphenyl (PCB) oil from forward hydraulics and piping	Burlington Environmental LLC Kent, WA
349,442	Pounds	PCB-contaminated solids*	Waste Management, Arlington, OR
5	Pounds	mercury	Burlington Environmental LLC Kent, WA
4	Pounds	hypodermic needles	Stericycle Kent, WA
120	cubic yards	friable asbestos	Waste Management, Arlington, OR

*Light ballasts, transformers, electrical equipment and other solids in contact with PCB oils.

In addition to removal of the preceding quantities of materials, the remaining insulation, surfaces, and piping that contained asbestos were encapsulated with a polymer (USCG *undated*).

Funding for the USCG Removal Action included $4,784,283 from the Oil Spill Liability Trust Fund (OSLTF) and $137,036 from the Superfund (USCG 2009). During the Removal Action, the USCG hired armed security guards in an attempt to keep vandals and drug users off the vessel. The USCG began to pursue a cost recovery case against the owner and is currently being pursued by the United States Department of Justice (USDOJ).

In January 2010, the USCG contacted EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program and informed EPA of the USCG's intent to use the GP to dispose of the vessel in the ocean or turn control of the vessel over to EPA for a Remedial Action. This contact initiated EPA's involvement with the investigations and actions at the LST-1166 vessel.

1.2.2 U.S. EPA

In January and March 2010, EPA conducted two inspections of the LST-1166 vessel. During these inspections, EPA personnel observed corroded and flaking painted surfaces throughout the interior and exterior of the vessel. Paint chips were observed littering most of the horizontal surfaces and deck floors. Further, paint was observed flaking off external surfaces of the hull and falling into the Columbia River. In addition, an unknown type of oil was observed floating atop the waters that had flooded the lower decks of the vessel, which was estimated at a depth of 20 feet. Foam was also observed to remain filling several rooms and interior spaces of the vessel.

1.3 Source, Nature, and Extent of Contamination

During inspections conducted by EPA in January and March 2010, painted surfaces throughout the interior and exterior of the vessel were observed to be corroding and flaking, with paint chips littering most horizontal surfaces and deck floors. In addition, it was evident that paint was flaking off of external surfaces and the hull and falling into the Columbia River. Correspondence between USCG and EPA confirmed that the interior paint contained both lead and PCBs, while the exterior paint contained only lead. On October 9, 2008, Crescere Marine Engineering, Inc. conducted an estimate of total surface area for paint removal from the vessel. The total paint removal area, including all interior and exterior areas of the vessel, was estimated at 519,456.5 square feet. The total paint removal area, excluding the exterior of the vessel, was estimated at 447,337.8 square feet.

Through correspondence with the USCG, EPA confirmed that the wiring was asbestos-insulated and contained hazardous amounts of PCBs. Most of the easily accessible wiring in the vessel has been removed by scavengers for the recyclable copper content. The electrical wiring that remains (estimated at 60 pounds) contains concentrations of PCB that range from <0.50 milligrams per kilogram (mg/kg) to 2,160 parts per million (ppm).

EPA observed that several rooms and interior spaces in the vessel were completely filled with foam. Correspondence between the USCG and EPA confirmed that the vessel was "filled" with polyurethane foam. The area of the foam was estimated to be 375 feet in length, 75 feet in width, and between 12 to 14 feet in depth. The foam was reported to be closed cell in nature and all tests reported that there was no contamination in the foam. It was reported that areas of the foam in one room were breached by vandals and had a small amount of asbestos contamination; however, those areas were remediated during the USCG's cleanup efforts.

During the USCG's Removal Action that was conducted in 2008-2009, insulation, surfaces, and piping that contained friable asbestos were encapsulated with a polymer. This encapsulated material was observed by EPA on board the vessel and was estimated to be approximately 80 cubic yards in volume. In addition, asbestos flooring was present in the mess hall of the vessel.

Finally, EPA observed an oily substance floating on the surface of approximately 20 feet of water in a limited viewing of an area of the lower deck of the vessel. The flooding occurred during breakage of a seal during the USCG's Removal Action in 2008-2009. The extent and volume of oil throughout the lower decks is unknown. No samples were collected to characterize this water.

1.3.1 Analytical Data

Following the Removal Action by the USCG in 2008-2009, USCG's contractor collected multi-media samples from the vessel. The sampling event included: collection of water for metals and PCBs analysis; collection of paint chips for metals and PCBs analysis; and collection of solids and/or oil for metals and PCBs analysis. All of the analytical data from the sampling event was reviewed by the EPA and its contractors. Concentration ranges for the constituents of potential concern (COPC), notably lead and PCBs, in all of the sampling media are summarized in Table 1.3.1. Hard copies of the data are available as part of the Administrative Record held by the USCG.

Table 1.3.1: Sample Results for COPC

Physical Location of Sample	Medium/Status	Analytical Result
Starboard side of the Tank Stowage Deck	Ballast tank water[2]	Lead 182 µg/L
Green paint taken from Pilot House walls	Flake sample of paint[3]	Lead 8200 mg/kg
White Paint Rib 56	Flake sample of paint[3]	Lead 71500 mg/kg
Stern Floor – Starboard	Oil on floor[2]	PCB 5120 µg/wipe
Front Port Hydraulic Equipment	Hydraulic oil[2]	PCB 4360 µg/L
Ceiling of Flag Officers Room	Electrical wiring[3]	PCB 2160 mg/kg
Portside Bow Oil	PCB contaminated solids[2]	PCB 361 mg/kg
Captains State Room	Electrical wiring[3]	PCB 72.6 mg/kg

[1] Defined in Data Package memo as containing "mixtures of…oil... and water…".

[2] Material was removed and disposed at facility listed in Table 1.2.1.

[3] Material remains on-board ship, some paint related material was removed from the ship in drums, and some from various areas of the ship, but the removal status for these is not clearly defined in the removal action data.

µg/L = microgram per liter

1.3.2 Constituents of Potential Concerns

Following EPA's assessments that were conducted in January and March 2010, it was confirmed that significant contamination remains on board the vessel including PCB contamination in interior paint, lead-based paint chip debris, and PCB contamination in wiring insulation. Samples were collected from flaking paint on the exterior and interior of the vessel. Samples were also collected from the wiring insulation and encapsulated asbestos-containing materials. Sample results confirmed that lead was present in the interior and exterior paint ranging from

3.42 ppm to 71,500 ppm, PCBs were present in the interior paint ranging from <0.5 ppm to 72.6 ppm, and PCBs were present in the asbestos wiring insulation ranging from <0.5 ppm to 2,160 ppm. Table 1.3.2 summarizes the COPCs and the estimated volume of the materials:

Table 1.3.2: Potential Sources of Contamination

COPC	Concentration Levels	Estimated Area/Volume
asbestos (sealed)	N/A	80 cubic yards
asbestos flooring (non-friable)	N/A	Mess Hall only; exact volume unknown
Lead-Based Paint	3.42 to 71,500 mg/kg	507,455.8 square feet[2]
PCBs in insulation	<0.5 to 2,160 mg/kg	60 pounds
PCB paint	<0.5 to 72.6 mg/kg	12,000 square feet

[1] Standards used during the USCG 2008/2009 removal action

2 Estimated volume of lead based paint chip debris in the interior of LST 1166 is 600 pounds.

1.4 Streamlined Risk Evaluation

This streamlined risk evaluation for the Site was prepared using the general guidance provided in EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA 1993). This risk evaluation is intermediate in scope between limited evaluation conducted for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions.

The purpose of this evaluation is to identify the COPCs using sampling data from the site, provide an estimate of how and to what extent humans and ecological receptors may be exposed to these chemicals, and qualitatively evaluate the health effects associated with the COPCs. The results of this comparison with screening levels will confirm the potential human health and

ecological risks posed by the site that justifies a removal action. The comparison will also help to focus the alternatives development by identifying the particular source or sources of contamination and associated risk. Furthermore, the results of the streamlined risk evaluation will provide the basis for developing appropriate cleanup levels as part of the Removal Action.

This streamlined risk evaluation addresses the removal action objective of protecting human health and the environment from exposure to: 1) lead-based paint chip debris, 2) PCB containing paint, 3) PCB containing electrical wiring and, 4) potentially friable ACM in the LST 1166.

- The total painted surface area aboard the LST-1166 is approximately 507,455 square feet. Lead concentrations in the lead-based painted surfaces ranged from non-detect to 71,500 ppm.
- Approximately 12,000 square feet of painted surface involves paint containing PCB in concentrations ranging between < 0.5 ppm to 72.6. ppm PCBs. Assuming an estimate of 200 square feet/gallon coverage of paint and assuming an average PCB concentration in the paint to be 50 ppm, it is estimated that the maximum total mass of PCBs in the paint on the LST-1166 is approximately 550 grams (Yender 2009).
- Most of the easily accessible wiring in the vessel has been removed by scavengers for the recyclable copper content. The electrical wiring that remains (approximately 60 pounds remain on board) contains concentrations of PCB that range from <0.50 mg/kg to 2,160 ppm, however the bioavailability potential is much lower than the PCB paint.
- The volume of ACM was not quantified (e.g., floor tile, insulation, etc.) but is reported to be in non-friable condition (USCG 2009), friable ACM has been removed or encapsulated.

Substances found on LST-1166, including the substances discussed the preceding section, constitute hazardous substances as defined by Section 101(14) of CERCLA, 42 U.S.C.§9601(14). Oils present and discharged from LST-1166, also discussed in the preceding section, meet the definition of “oil” and “discharge” as defined in Sections 311(a)(1) and (2) of the Clean Water Act (CWA), 33 U.S.C. §1321(a)(1) and (2) and Sections 100(23) and (7) of the OPA, 33 U.S.C. §2701(23) AND (7). Disposal of PCBs is also regulated by the Toxic Substance Control Act (TSCA), 40 CFR Part 761 Subpart D.

This streamlined risk evaluation for the Site assumes any hazardous substances with COPCs pose an actual or potential threat to human health or welfare, or the environment. Site investigations have adequately defined the extent of the COPCs that are present in source materials to proceed with this EE/CA.

1.4.1 Human Health Risks

Threats from exposure to contaminants onboard the vessels are present for human receptors. The elevated concentration of hazardous substances and exposure of contaminated surfaces or friable ACM or lead dust to the environment indicates that inhalation and ingestion (air) exposure pathway potentially exist. Trespassers could be exposed to the contaminants. In the event of future recycling activities workers may have occupational exposure. The cleanup level for lead dust on floors is 40 microgram per square foot (µg/ft²) (EPA 2001). Other pathways (e.g., soil, surface water, sediment, ground water) are not complete for human health.

The potential for PCB to leach to surface water is also evaluated as the vessel is flooded and in direct hydraulic communication with the River. Surface water circulates through the vessel with the change in river stage. The U.S. Navy studied several types of solid PCB products to determine the amount of PCBs that leach out of each type of material in a shallow ocean reef setting. The leach rate study found that the PCBs in the electrical cabling are very stable and that only very small amount of PCBs moved out of the cabling and into the surrounding water over the 2 year study. The results showed that bulkhead insulation has the highest leach rate. A complete risk assessment was conducted for two "high risk groups" – scuba divers and angler fishermen and their families. The results of the risk assessment showed the water will be safe for scuba diving and both adults and children can safely eat fish caught at the artificial reef (U.S. Navy Fact Sheet 2011).

1.4.2 Ecological Risks

Ecological receptors, including mammalian, fish, and marine plant receptors could potentially be exposed to elevated levels of contaminants (lead and PCB) found in the Columbia River (surface water), or sediments contaminated by these materials. ACM is not considered a COPC for ecological receptors.

An ecological risk assessment conducted by the Marine Environmental Support Office, Space and Naval Warfare Systems Center for the Program Executive Office (PEO) Ships for vessel disposal to create shallow artificial reef concluded that total PCB exposure levels predicated by the models showed no indication of risk to plants, invertebrates, fish, sea turtles, and sharks/barracudas that could live, feed, and forage on the reef (PEO Ships 2006). The scenario in the study involves sinking a vessel requiring risk-based disposal approval per 40 CFR 761.62(c) for bulk PCBs in solid material at concentrations greater than 50 ppm.

Additionally, The USGS measures the annual discharge for the Columbia River at The Dalles, Oregon at River Mile 194. The average annual discharge for 1879-1999 was 86,175,360 gallons per minute.

The risk of lead based paint chips accumulating in sediment is discussed below. PCB paint chips are not addressed as they are not on the exterior of the vessel. Benthic biota are exposed to pollutants accumulated within the sediments and may transfer potentially toxic concentrations through the food web to organisms in higher trophic levels. Aquatic toxicity testing has determined that many animal species are detrimentally affected at very low concentrations of heavy metals (such as lead). Indirect and direct exposure to contaminated sediments may have chronic or acute effects on many species. Benthic invertebrates have been shown to suffer toxic effects from heavy metals.

As the vessel deteriorates chips of lead based paint flake off the hull and superstructure and drop into the river. The high flow rates transport the chips an unknown distance down-stream before they are deposited on the sediment. The distance from the vessel is partially controlled by the chip size and water velocity. Sand transport in the lower Columbia River is driven by the river discharges. Annually, the lower Columbia River sand transport is highly variable ranging from approximately 0.1 million cubic yards (mcy) in 1926 to over 37 mcy in 1984. Since 1975, the average annual sand transport is about 1.3-mcy/yr (USACE *undated*).

Given the random flaking of the paint from the hull, high flow rates and high sedimentation rates in the river the possibility that paint chips could accumulate in sediment at concentrations presenting a threat to benthic biota appears to be extremely low.

The USCG removed the oils and lubricant from the vessel during an earlier removal action eliminating risks to ecological receptors. The COPCs that remain do not pose an actionable risk to ecological receptors.

1.4.3 Conceptual Site Model

LST 1166 is moored in the Columbia River. The vessel is flooded, its hull rest on the river bed and is in hydraulic communication with the river. The USCG has removed all oils and lubricants. The vessel is deteriorating. Interior paint is peeling and flaking to the deck floors. Exterior lead based paint is flaking into the river. Circulating water in the flooded levels of the vessel is in contact with lead based paint, PCB containing paint and electrical wiring. ACM which remains in the vessel is not currently friable.

The risk evaluation concludes that trespassers and potential future occupational workers may potentially have inhalation and ingestion exposure via the air pathway. Other human pathways are incomplete. The risk evaluation concludes that there are unlikely any complete pathways for ecological exposure.

1.4.4 Uncertainty Analysis

ACM on board is not currently in a friable state and could change. PCBs in paint are bound in the matrix of the paint solid structure and, as such, are not available in a form that would expose or be bioavailable to marine organisms. PCBs exhibit very low water solubility in water. Therefore, it is not expected that these PCB laden paints will leach out free PCBs into the water column. Similarly lead in paint would not readily leach into the water column.

2.0 IDENTIFICATION OF REMOVAL ACTION SCOPE, GOALS, AND OBJECTIVES

This section presents the objective(s) for the proposed removal action. The purpose, scope, and scheduling requirements for implementation of the removal action alternatives are also described in this section in order to define removal action requirements based on time, budget, technical feasibility, and relevant criteria and standards.

2.1 Statutory Limits on Removal Actions

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Commented [MSOffice1]: EPA will provide language.

2.2 U.S. EPA and U.S. CG Responsibilities

The LST-1166 is clearly within the USGS's Area of Responsibility (AOR) for which it is the lead agency for response incidents under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Area Contingency Plan (ACP). This includes spill responses and removal actions conducted pursuant to the federal CWA as amended by the Oil Pollution Act of 1990 (OPA), and CERCLA.

As lead agency, the USGS previously ordered the owner of the vessel to remove contaminants from the vessel and submit a comprehensive plan which could possibly conclude with vessel disposal at sea. Such disposal would have required obtaining EPA's approval and use of EPA's GP (40 CFR Part 229.3) for the transportation and disposal of vessels in ocean waters pursuant to MPRSA. Lloyds of London's contractor sought authorization to use the ODGP to dispose of the LST-166 at sea, but authorization was not granted by EPA because the contaminants had not been removed and the terms of the ODGP had not been met. It has since been determined that, due to the presence and levels of PCBs onboard, disposal of PCBs on the LST-116 is the ocean is also covered by the TSCA.

The USCG has also expressed interest in disposal of the vessel in the ocean, but has explored other options such as decontamination and recycling. EPA has offered assistance to the USGS for the limited purpose of preparing a draft EE/CA to assess a limited number of removal action alternatives appropriate for the vessel.

2.3 Removal Action Objectives

The goal of this EE/CA is to capture, contain and remove the hazardous materials, oil, and physical hazards, such as loose equipment and mechanical devices, from LST-1166 and properly

dispose of the vessel. This includes eliminating the potential for contaminated materials onboard LST-1166 to act as a source to surface water, sediments, soils and ground water, in a manner that is protective of human health and the environment and to attain applicable or relevant and appropriate requirements (ARARs) to the extent practicable.

Removal Action Objectives (RAOs) consist of goals for protecting human health and the environment and drive the formulation and development of the removal alternatives. The following represent the RAOs for LST-1166:

- Prevent actual or potential contamination of sensitive ecosystems from hazardous substances or pollutants or contaminants associated with LST-1166 [40 CFR 300.415 (b)(2)(ii)].
- Eliminate actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants associated with LST-1166 [40 CFR 300.415 (b)(2)(i)]. This includes the following:
    - **Paint**: Peeling, chipped, or exfoliating paint must be removed from walls and floors where it is found, including upper and lower decks, passageways, and stairs.
    - **Oils**: Oils and fuels will be removed to the maximum extent practicable.
    - **Debris**: Removal, welding or caging of engines, generators, cables, winches, girders, several boom arms and other assorted equipment that is capable of detaching from the vessel during disposal operations and becoming floating debris. The equipment must be inspected and any residual liquids removed.
    - **Foam** –Any loose, exposed foam must be removed from the vessel. All compartments filled with foam must be securely sealed for during transport and disposal operations.
    - **PCBs** – Remove PCB wiring.
    - **Asbestos –** Remove any remaining friable asbestos.

The USCG plans to eliminate access to LST-1166 due to unacceptable exposure risks to human and ecological receptors from contamination which remains on LST-1166. The USCG has elected to remove and dispose of LST-1166 to address these unacceptable exposure risks to human and potential ecological receptors and intend the selected removal alternative to be the final action for LST-1166.

2.4 Determination of and Compliance with ARARs and other Criteria

Section 300.415(j) of the NCP provides that removal actions pursuant to CERCLA Section 106 attain ARARs under Federal or State environmental laws or facility siting laws, to the extent practicable considering the urgency of the situation and the scope of the removal. In addition to legally binding laws and regulations, many federal and state environmental and public health

programs also develop criteria, policies, guidance, and proposed standards that are not legally binding; however, they may provide useful information or recommended procedures. These "To Be Considered" criteria or "TBCs" are not potential ARARs, but are generally evaluated along with ARARs. Applicable ARARs and TBCs for this EE/CA are defined based on the nature of the contaminants identified and the potential Alternatives, and are further summarized below.

2.4.1 Contaminant Specific ARARs

Contaminant specific requirements include Hazardous and Solid Waste, Resource Conservation and Recovery Act (RCRA) Subtitle C – Hazardous Waste Characteristics, and RCRA Subtitle D – Non-hazardous Solid Waste (40 CFR Parts 257 and 258), Oregon Department of Environmental Quality Solid Waste Management (ORS Chapter 459) and Hazardous Waste and Hazardous Materials Management (ORS Chapters 465 and 466), and the Toxics Substance Control Act (TSCA) (40 CFR 761 Subpart D).

2.4.2 Location Specific ARARs

The geographic and physical position of the LST-1166 determines the ARARs regarding the concentration of hazardous substances and cleanup activities due to their location in the environment. The Fish and Wildlife Conservation Act, Migratory Bird Treaty Act (MBTA), Endangered Species Act (ESA) (16 USC 1531; 40 CFR Part 6.302; 50 CFR Part 402), Marine Mammal Protection Act (MMPA) and Fish and Wildlife Coordination Act (FWCA) are all applicable for the vessel at its moorage and along the entire distance to its disposal location. Once the final alternative is selected the substantive requirements of applicable elements of each Act must be met. Best Management Practices (BMPs) are also applicable to each alternative. The National Historic Preservation Act (Public Law 89-665; 80 Stat. 915; 16 U.S.C. 470) was potentially applicable, but the Oregon State Historic Preservation Office determined that the vessel is not eligible for National register of Historic Places (Johnson 2011).

The General Permit for Ocean Dumping (40 CFR 229.3) for transportation and disposal of vessels is applicable. However, paint flakes on the exterior hull are not "other pollutants" or are they "readily detachable" [40 CFR 229.3(3)(ii)]. Additionally, should any paint flakes become dislodged during transportation or disposal they would not create "debris or contribute to chemical pollution". Protection of Wetlands Order (40 CFR Part 6), and the MPRSA also known as the Ocean Dumping Act are also applicable.

2.4.3 Action Specific ARARs

Action specific ARARs for include the CWA, Section 404 (33 CFR Part 336), Wetlands -

Protection of Wetlands Order (40 CFR Part 6), Hazardous and Solid Waste, Resource Conservation and Recovery Act (RCRA) Subtitle C – Hazardous Waste Characteristics, and RCRA Subtitle D – Non-hazardous Solid Waste (40 CFR Parts 257 and 258), Oregon Department of Environmental Quality Solid Waste Management (ORS Chapter 459) and Hazardous Waste and Hazardous Materials Management (ORS Chapters 465 and 466), TSCA (40 CFR 761 Subpart D).

2.5 Removal Schedule

The general schedule for removal activities, including both the start and completion time for the non-time critical removal action (NTCRA), will be subject to determinations to be made by USCG. Table 2.5.1 shows general removal schedule.

Table 2.5.1: Removal Schedule

Activity	Duration	Alternatives
Structural Assessment	3 days	All
Inspection	3 days	All
Removal of solid/hazardous waste	55 days*	1, 2
Removal and treatment of non-oily water	**	All
Disposal of solid/hazardous waste	**	1, 2
Preparation of decks, hull and superstructure	20 days*	1, 2
Relocate vessel to dry dock	10 days	3
Remove solid/hazardous waste	40 days	3
Dismantle ship for recycling	50 days	3
Disposal of solid/hazardous waste	5 days	3

Tow and dispose of vessel at sea	5 days	1, 2
Draft After Action Report	45 days	All

*Assumes two shifts

**Assumes activities would be concurrent with Removal of solid/hazardous waste

The anticipated removal activities for schedule for Alternatives 1 and 2 are approximately 131 days. The anticipated removal activities for schedule for Alternatives 1 and 2 are approximately 211 days.

3.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Technologies and options applicable to this removal action were considered and screened. These include:

- Decontamination
- Treatment
- Recycling
- Disposal

A limited number of removal action alternatives were assembled from these technologies and options as viable or appropriate alternatives. Based on the nature and extent of contamination and on the RAOs developed in Section 2.3, three alternatives were assembled for detailed analysis.

3.1 Identification and Analysis of Removal Action Alternatives

The following alternatives have been developed for off-site disposal of LST-1166:

- Ocean Disposal with Limited Decontamination
- Ocean Disposal with Full Decontamination
- Decontamination, Dismantling, and Recycling/Disposal

Disposal is a major component of any alternative in order to satisfy the RAOs. However, recycling, treatment and decontamination are technological options incorporated in some of these alternatives. These options have been developed to provide a range of options (alternatives) to compare effectiveness, implementation and cost in addressing the removal action objectives discussed in Section 2.3.

Based on the identification and analysis of the removal action alternative applicable to this Site, the alternatives are selected for detailed analysis included in the following sections.

3.1.1 Alternative 1: Ocean Disposal with Limited Decontamination

This removal action alternative includes the following actions:

- Pre-removal structural assessment and inspection

  Pre-removal inspection and assessment of the vessel will include assessing the structural integrity of the various areas (e.g., decks, hull, superstructure, etc.). It will also include

inspection of environmental conditions in and outside the vessel. The inspection will cover areas that could not be inspected during previous inspections. The information generated from the pre-removal assessment and inspection will be used to develop or finalize the removal design work plan and for site health and safety. The results of the structural assessment will also identify any areas of the vessel that would require reinforcing before the vessel is towed to sea.

- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste

  Solid and hazardous wastes that have been placed in 55-gallon drums will be loaded on trucks and transported to an off-site permitted landfill for disposal.

- Removal and disposal of approximately 600 pounds of loose friable paint chips

  Loose friable and paint chips will be vacuumed from floors and surfaces of the vessel. A HEPA-equipped vacuum will be used for this cleanup. The waste will be collected in 55-gallon drums which will be transported by trucks to an off-site permitted landfill for disposal.

- Removal and disposal of approximately 40,000 cubic yards of foam (non-hazardous)

  During the inspection of the vessel it was observed that trespassers had exposed and removed foam in certain areas of the vessel. Polyurethane foam will be restricted in closed compartments in order to successfully scuttle the vessel at the bottom of the ocean. All loose and exposed foam will be removed from the vessel. It is estimated that approximately 40,000 cubic yards of foam needs to be removed from the vessel. The removed foam will be transported by trucks to a non-hazardous waste landfill.

- Removal and treatment of 500,000 gallons of non-oily water

  U.S. EPA inspection of the vessel in 2010 indicated the presence of standing water (20 feet deep) in the lower two decks due to a broken seal (EPA 2010a). The water will be pumped out through a carbon filter to remove suspended solids and discharged back to the river. It is anticipated that a small amount sludge may be generated and will be disposed off-site at a permitted non-hazardous landfill. The seal will be inspected and repaired to ensure water is removed to the extent practicable.

All solid/hazardous wastes removed will be disposed off-site at a permitted treatment, storage and disposal (TSD) facility in accordance with state and federal laws. PCB paint removal, except for friable chips, would not be conducted under this alternative. The cost estimates for these activities are included in Table 1 of Appendix A.

The following activities will be carried out to prepare the vessel for disposal.

- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull

The above activities include removing or securing all loose equipment, removing any residual oils in the equipment, and generally removing or securing any loose items that could become floating debris during disposal. On the deck and the lower tank transport deck, EPA observed engines, generators, cables, winches, girders, several boom arms and other assorted equipment. Some of this equipment appeared possibly functional, but all of it appeared capable of detaching from the vessel during disposal operations and becoming floating debris. The equipment will be removed, welded or caged to the vessel before the vessel can be scuttled. Some of the equipment may contain residual oils and this equipment will be inspected and if residual oils are discovered they will be removed, if practical.

Below are detailed activities that will be carried out during preparation and removal at various areas of the vessel before disposal.

1. Upper deck area:

    a. Rear deck: Winches will be battened down and welded in place.
    b. Midships: There are forklifts at midships which could contain residual oils. The forklifts will be removed or cleaned and tied down.
    c. Ropes and cables, steel on deck will be removed and disposed as appropriate.
    d. Stern end, starboard and port: Draw works and winches will be secured to the deck by bolts or welding. A boom or lift arm on the on one end appears to be resting on the deck, the other is attached to the winch. The free end must be welded down.
    e. Pallets and hoses at rear deck, and engines, generators will be removed.
    f. Mid-deck: Presence of girders; rusty and flaked paint were observed. Loose flaked, exfoliated and peeled paint will be removed. Paint chips on the deck itself will be removed from the vessel. Girders will either be removed or taken to a lower deck and either welded in place or secured in a sealed compartment.

g. Bow: steel ramp and wooden hatch cover: The wooden hatch cover will be removed and disposed off site. The steel ramps are apparently used to seal below deck areas off and must remain in place. Measures will be taken to ensure these ramps are firmly welded in place before disposal.
h. Bow chain house: Chains will be removed.

2. Superstructure: This consists mostly of the Pilot House at the rear of the vessel.

    a. Chips of flaking paint were observed on the deck and walls in the superstructure. These paint chips will be removed and properly disposed off site.
    b. There were several capacitors in the officer's area which will be removed from the vessel.

3. Rear Mess deck: This area consists of a mess hall, laundry and cooking area. There is flaking paint PCBs containing paint.

4. Military Tank Storage deck: The following applies to all equipment remaining on this deck. It was observed at least several engines, generators and other machinery standing at various locations. If equipment can be removed from the vessel, then it will be removed, otherwise, it will be thoroughly checked and cleaned of any residual oils, and then either welded down, or confined within a caged area.

5. Lower decks: These decks could not be inspected due to standing water, following breakage of a seal. The depth of this water was estimated at as much as 20 feet deep. The lower decks have apparently been cleaned of petroleum-based liquid and fuels. The water will be pumped out through a filter before inspecting the lower decks to determine if they have been cleaned of liquid fuels and petroleum products to the maximum extent practicable, as specified in the general permit (40 CFR 229.3) requirements.

- Disposal

The vessel will be towed to a location approximately 65 nautical miles from the mouth of Columbia River (Figure 2 – Disposal Location Map) and will be scuttled to the bottom of the ocean floor at the depth of approximately 1,000 fathoms (over a mile). Sinking the vessel to the bottom of the ocean will involve mechanical perforation of the exterior hull allowing the ship to flood. The location of the disposal will be mapped using Geographic Information System (GIS). Best management practices (BMPs) and engineering controls will be employed to minimize impact of this removal on human health and the environment. A weather window from May to August exists for towing the vessel to the ocean.

Effectiveness: This alternative will permanently remove the source of contamination from the current location, eliminate potential exposure routes, and protect public health, the environment and ecology of the Columbia River, and the community. Short-term, there is a potential exposure to the workers preparing the vessel for removal. However, this can be minimized by use of BMPs, engineering controls and appropriate personal protective equipment. This alternative complies with the ARARs identified in Section 2.5, and meets the RAOs as it removes all potential contamination from the current location. The final disposition of the vessel is a long-term solution that addresses the current conditions and concerns.

At the disposal location, PCB-containing paint, lead-based paint and electrical wiring containing PCBs will be entombed, however, at 1,000 fathoms below the surface of the ocean, there are no human receptors and impact to any ecological receptors are minimal. The contamination remaining in the vessel will have minimal impact on the environment because the fate and transport of lead and PCBs in paint indicates that these constituent will not likely leach to the environment under the prevailing pressure, temperature and salinity (Yender 2009), (U.S. Navy Fact Sheet 2011), (PEO Ships 2006). Therefore, this alternative will have no impact on any potential receptors and is likely more protective since the vessel will be scuttled at a depth much greater than the shallow reef for which the human health and ecological risk assessments were conducted.

Implementability: This alternative is technically feasible as the technical know-how of such operations exists and firms with demonstrated performance record are available. According to the Department of Transportation Maritime Administration (MARA) since 2001 approximately 100 ships have been disposed at sea (MARA 2011). The activities under this alternative can be implemented in a relatively short period of time (less than one year). Equipment, personnel and services to conduct the above activities are readily available. Off-site treatment and disposal facilities are available for wastes requiring disposal. This alternative is administratively feasible as permitting anticipated is minimal (i.e., Ocean Dumping General Permit). No easement or right-of-ways for site access are anticipated, and no impacts to any adjoining properties are expected. State and public acceptance of this removal action will be determined during public comment period of the EE/CA.

Cost: The total estimated cost for this alternative is $2,892,242. Since the anticipated time frame for the completion of the removal is less than 12 months, the estimated cost is equal to the capital cost for the base year. As such no present worth costs are calculated, since no operation and maintenance (O&M) cost will be incurred as post removal site control is not required. Details of the cost estimate and assumptions used are presented in Section A.1.1 and Table 1 of Appendix A.

3.1.2 Alternative 2: Ocean Disposal with Full Decontamination

This removal action alternative includes all the activities outlined under Alternative 1. In addition, the following additional activities will be conducted under this alternative:

- Removal and disposal of approximately 60 pounds of electrical wiring

  Most of the easily accessible wiring in the vessel has been removed by scavengers for the recyclable copper content. The electrical wiring that remains (approximately 60 pounds remain on board) will be removed and disposed off site at a permitted TSD facility. Reported concentrations of PCB that range from <0.50 mg/kg to 2,160 ppm, therefore, disposal facility shall be in compliance with the requirement of TSCA for PCB disposal.

- Removal and disposal of approximately 600 pounds of loose friable paint chips

  Loose friable and paint chips will be vacuumed from floors and surfaces of the vessel. A HEPA-equipped vacuum will be used for this cleanup. The waste will be collected in 55-gallon drums which will be transported by trucks to an off-site permitted landfill for disposal.

- Removal and disposal of PCB paint from an area measuring approximately 12,000 square feet.

  PCB paint will be removed using appropriate PCB paint removal methods, including sand blasting, bead blasting, water blasting, and scarification. PCB containment method commensurate with the method used will be utilized during the removal process. Appropriate personal protective equipment (PPE) and dust control measure will be implemented. The waste will be disposed off-site at a permitted TASCA or RCRA Subtitle C landfill.

Following removal, the vessel will be prepared and secured, and disposed as described under Alternative 1.

Effectiveness: This alternative will permanently remove the source of contamination from the current location, eliminate potential exposure routes, and protect public health, the environment and ecology of the Columbia River, and the community. Additionally, this alternative removes PCBs in the solid materials on the vessel, thereby minimizing any impact at the disposal

location. Short-term, there is a potential exposure to the workers preparing the vessel for removal. However, this can be minimized by use of BMPs, engineering controls and appropriate personal protective equipment. At the disposal location, at the bottom of the ocean, there are no human receptors that will come into contact with any residual contamination and it is expected that PCBs will be removed from the vessel entirely leaving no source of contamination. This alternative complies with the ARARs identified in Section 2.4, and meets the RAOs as it removes all potential contamination and no concerns of residual effect exist. The final disposition of the vessel is a long-term solution that addresses the current conditions and concerns.

Implementability: This alternative is technically feasible as the technical know-how of such operations exists and firms with demonstrated performance record are available. The activities under this alternative can be implemented in a relatively short period of time (less than one year). Equipment, personnel and services to conduct the above activities are readily available. The complexities introduced by the removal and disposal of PCB paint surfaces are reflected in the higher cost of this alternative, but do not affect its technical feasibility. Off-site treatment and disposal facilities are available for wastes requiring disposal. This alternatively is administratively feasible as permitting anticipated is minimal (i.e., Ocean Dumping General Permit). No easement or right-of-ways for site access are anticipated, and no impacts to any adjoining properties are expected. State and public acceptance of this removal action will be determined during public comment period of the EE/CA.

Cost: The total estimated cost for this alternative is $3,212,791. Since the anticipated time frame for the completion of the removal is less than 12 months, the estimated cost is equal to the capital cost for the base year. As such no present worth costs are calculation, since no O&M cost will be incurred as post removal site control is not required. Details of the cost estimate and assumptions used are presented in Section A.1.2 and Table 2 of Appendix A.

3.1.3 Alternative 3: Decontamination, Dismantling and Recycling/Disposal

This removal action alternative incorporates all the activities outlined under Alternative 2, except the disposition of the vessel. However, some of the activities outlined in Alternative 2 are conducted in different sequences and locations. The following activities are unique to Alternative 3:

- After removal and treatment of approximately 500,000 gallons of non-oily water and securing equipment onboard, the vessel will be then towed using tugs to a dry dock. This activity will be conducted as described under Alternative 1.

- Removal of the solid and hazardous materials outlined in Alternatives 1 and 2 will be carried out at the dry dock.
- After PCB removal, the superstructure and any other recyclable materials will be segregated from non-recyclable solid wastes for recycling/disposal.
- It is anticipated that approximately 2,400 tons of steel/metal will be recycled.

Effectiveness: This alternative will permanently remove the source of contamination, eliminate potential exposure routes, and protect public health, the environment and ecology of the Columbia River, and the community. Short-term, there is a high potential exposure to the workers preparing the vessel for removal and dismantling. However, this can be minimized by use of BMPs, engineering controls and appropriate personal protective equipment. No residual contamination is expected to remain once removal is complete. This alternative complies with the ARARs identified in Section 2.4, and meets the RAOs as it removes all potential contamination and no concerns of residual effect exist. The final disposition of the vessel is a long-term solution that recycles/disposes the vessel and its contents in an appropriate manner.

From the standpoint of green remediation principles, this alternative would be effective at reducing the carbon footprint through recycling the scrap steel/metal comprising the vessel, and produce economic benefit at the steel/metal end of life cycle. In addition, this alternative creates more jobs than Alternatives 1 and 2.

Implementability: This alternative is technically feasible as the technical know-how of such operations exists and firms with demonstrated performance record are available. The activities under this alternative can be implemented in a relatively short period of time (less than one year). Equipment, personnel and services to conduct the above activities are readily available. The complexities introduced by the removal and disposal of PCB and lead paint surfaces, and dismantling of the vessel are reflected in the higher cost of this alternative, but do not affect its technical feasibility. Off-site treatment and disposal facilities are available for wastes requiring disposal. This alternatively is administratively feasible as no permitting is anticipated . No easement or right-of-ways for site access are anticipated, and no impacts to any adjoining properties are expected. State and public acceptance of this removal action will be determined during public comments and evaluation of the EE/CA and Action Memorandum.

Cost: The total estimated cost for this alternative is $4,110,184. Since the anticipated time frame for the completion of the removal is less than 12 months, the estimated cost is equal to the capital cost for the base year. As such no present worth costs are calculation, since no O&M cost will be incurred as post removal site control is not required. Dismantling a ship a complex and

costly task, however, this cost is offset by the benefits realized from recycling the vessel's scrap steel/metal. In addition, this alternative creates more jobs than Alternatives 1 and 2.
Details of the cost estimate and assumptions used are presented in Section A.1.3 and Table 3 of Appendix A.

4.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

In this section, removal action alternatives are analyzed against the three criteria as outlined in the NTCRA Guidance: effectiveness, implementability, and cost. Each of these criteria is described below.

> Effectiveness: How well each alternative (1) protects public health and the environment, including long-term effectiveness and permanence and short-term effectiveness, (2) complies with ARARs, and (3) achieves removal objectives.
>
> Implementability: The technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation.
>
> Cost: The direct and indirect capital costs and annual post removal site control (PRSC) costs associated with an alternative.

The analysis of the three alternatives with regard to these three criteria is presented in Section 3.0.

Below is a summary of comparative evaluation of the alternatives with regard to effectiveness, implementability and cost. These Alternatives are:

Alternative 1: Ocean Disposal with Limited Decontamination

Alternative 2: Ocean Disposal with Full Decontamination

Alternative 3: Decontamination, Dismantling and Recycling/Disposal

Effectiveness: All three alternatives are protective of public health, the environment and ecology of the Columbia River, and the community. All three alternatives permanently remove the source of contamination to humans and ecology of the Columbia River. However, because of the level of decontamination and final disposition of the vessel, Alternative 3 has a benefit over the other two alternatives as no disposal in the ocean will occur and environmental benefits from recycling will be achieved. In addition, Alternative 3 creates more jobs than Alternatives 1 and 2. Similarly, Alternative 2 provides a level of decontamination that does not allow disposition of PCBs at the bottom of the ocean.

All three alternatives will have potential short-term impact on workers; however, this impact is minimal for Alternative 1. The degree of potential short-term impact is greater for Alternatives 2 because of the level of decontamination and much higher for Alternative 3 because of the

dismantling activities. The short-term impact can be mitigated by implementing BMPs, engineering controls and appropriate personal protective equipment.

All three alternatives meet the ARARs and the removal action objectives as they permanently remove the source of contamination and eliminate the exposure routes. Although in Alternative 1 the decontamination is minimal, there are no exposure routes that are complete at the vessel's disposal location and risk assessment by the U.S. Navy has shown no impact from similar contamination at a coral reef setting. Therefore, no residual effect on human health and the environment is anticipated.

Implementability: All three alternatives are technically feasible, because the know-how of the operations for these alternatives exists, and firms with track record in decontamination, dismantling or scuttling a ship are available. Equipment and personnel are readily available for all three alternatives. There are varying degrees of difficulty in implementing each alternative. Alternatives 1 and 2 present the challenge of safely sinking the ship to the bottom of the ocean, and Alternatives 3 presents the challenge of dismantling the vessel and segregation of recyclable materials from the solid/hazardous waste for disposal. These degrees of difficulties are reflected in the cost and do not impact the technical feasibility of each alternative. All three alternatives can be implemented in a relatively short period of time (less than 12 months). All three alternatives are administratively feasible as no easement or right-of-ways for site access are anticipated, and no impact to any adjoining properties is expected. There will be permit requirements for Alternatives 1 and 2 for the ocean disposal (i.e., Ocean Dumping General Permit). No permits are anticipated for Alternative 3.

Cost: The detailed estimated costs for the alternatives are presented in Tables 1 through 3 in Appendix A. Since the removal actions will be completed within a period of 12 months all costs are capital cost of the base year (2011). The total estimated costs of the alternatives are $2,892,242, $3,212,791 and $4,110,184 for Alternatives 1, 2, and 3, respectively. The costs for all three alternatives are in the same order of magnitude. While Alternative 3 is the most expensive, Alternative 3 has green remediation component; the other alternatives do not. In addition, Alternative 3 creates more jobs than Alternatives 1 and 2.

The cost estimates in this EE/CA are based on the description of the alternatives and associated assumptions presented in this EE/CA. The assumptions used here are reflective of the activities anticipated and sufficient for the purposes of comparative evaluation of the alternatives, but are not necessarily the same as the design basis that would be used for the final, detailed design.

The cost estimates were prepared to allow comparative evaluation of alternatives, not for budgeting purposes. The uncertainties in the EE/CA designs and associated cost estimates are such that actual costs could vary significantly from these estimates. However, the uncertainty in the *relative* cost of the alternatives is much less than the uncertainty in the magnitude of the costs, and these cost estimates are suitable for comparative evaluation of the alternatives.

This evaluation reveals that Alternative 3 is the preferred alternative. Table 4.1 summarizes the comparative analysis.

Table 4.1: Comparative Analysis Summary

NTCRA Criteria	Alternative 1: Ocean Disposal with Limited Decontamination	Alternative 2: Ocean Disposal with Full Decontamination	Alternative 3: Decontamination, Dismantling and Recycle/Disposal	Comment
Effectiveness:	Protective of public health and community, and ecology. Protective of workers and the environment. Leaves contaminants in the vessel at disposal location. Achieves ARARs and meets RAOs by eliminating exposure routes.	Protective of public health and community, and ecology. Protective of workers and the environment. No residual PCB concern at disposal location. Achieves ARARs and meets RAOs by eliminating exposure routes.	Protective of public health and community, and ecology. Protective of workers and the environment. Achieves ARARs and meets RAOs by eliminating exposure routes.	Although risk assessment for a scenario at a shallower depth showed no risk from the level contamination on the vessel, Alternative 3 is rated the highest since ocean disposal is not part of this alternative. The other two are rated relative to the level of decontamination achieved.
Effectiveness Qualification	**Good**	**Good**	**Better**	
Implementability	Technically feasible. Know-how, equipment and personnel are readily available. No easements or right-of-way required. No impact to adjoining properties anticipated. Minimal permitting for ocean disposal.	Technically feasible. Know-how, equipment and personnel are readily available. No easements or right-of-way required. No impact to adjoining properties anticipated. Minimal permitting for ocean disposal.	Technically feasible. Know-how, equipment and personnel are readily available. No easements or right-of-way required. No impact to adjoining properties anticipated. No permitting anticipated.	Ocean Dumping General Permit is required for Alternatives 1 and 2. No permitting is anticipated for Alternative 3, but it has more complex activities. Cost offsets any complexities in implementation.
Implementability Qualification	**Good**	**Good**	**Good**	
Cost	$2,892,242	$3,212,791	$4,110,184	Alternative 3 has green remediation component; the other alternatives do not. In

				addition, Alternative 3 creates more jobs than Alternatives 1 and 2.
Cost Qualification	**Good**	**Good**	**Good**	
Total Score	**Good**	**Good**	**Better**	

5.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Alternative 3 best satisfies the evaluation criteria based on the comparative analysis in Section 4.0.

In summary, all three alternatives provide similar levels of protectiveness, and have similar levels of implementability. However, Alternatives 3 provides a level of protection higher than the other alternatives for an incrementally higher cost. Alternative 3 included a green remediation component which offsets the higher cost in the implementation of a more complex alternative. In addition, Alternative 3 creates more jobs than Alternatives 1 and 2. Therefore, Alternative 3, Decontamination, Dismantling and Recycle/Disposal is the preferred removal alternative.

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PHOTOGRAPH

Photo 1

Photo # K-78101 USS Washtenaw County moored in Subic Bay, October 1969

FIGURES

Figure 1: Site Location Map

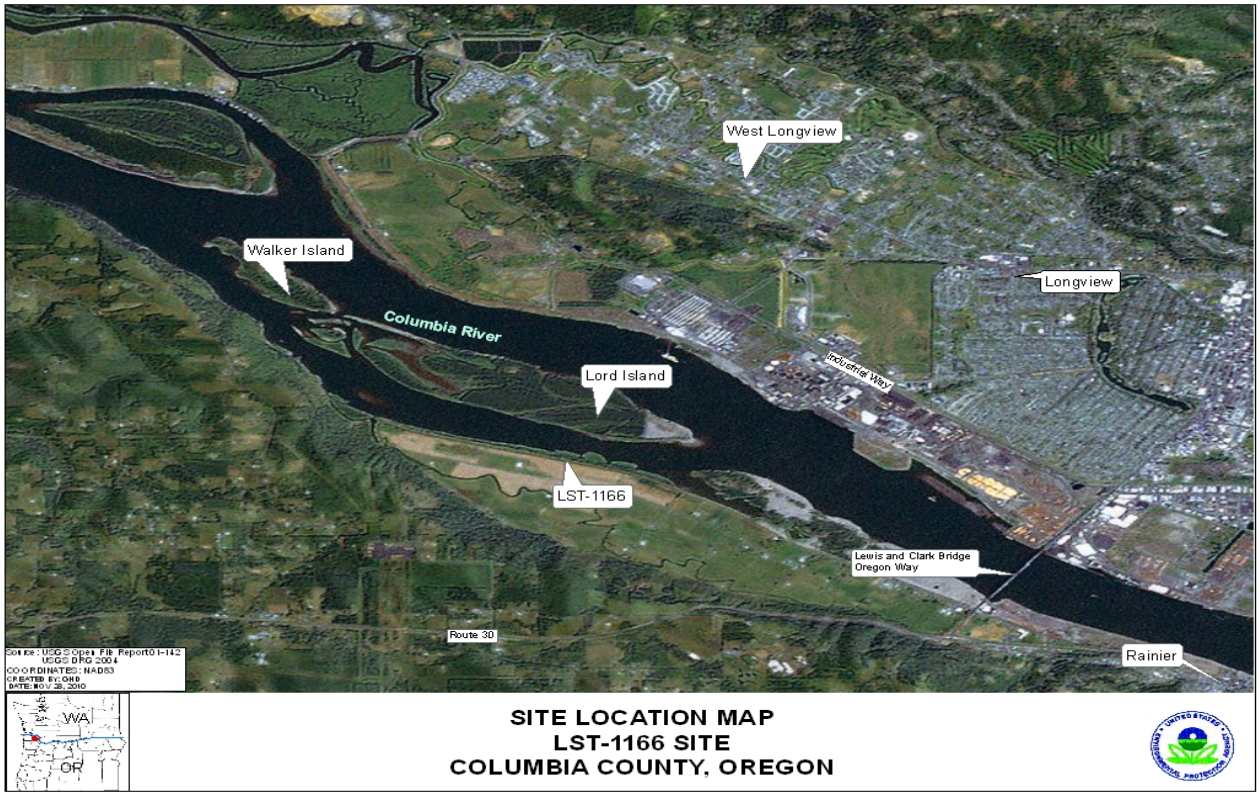
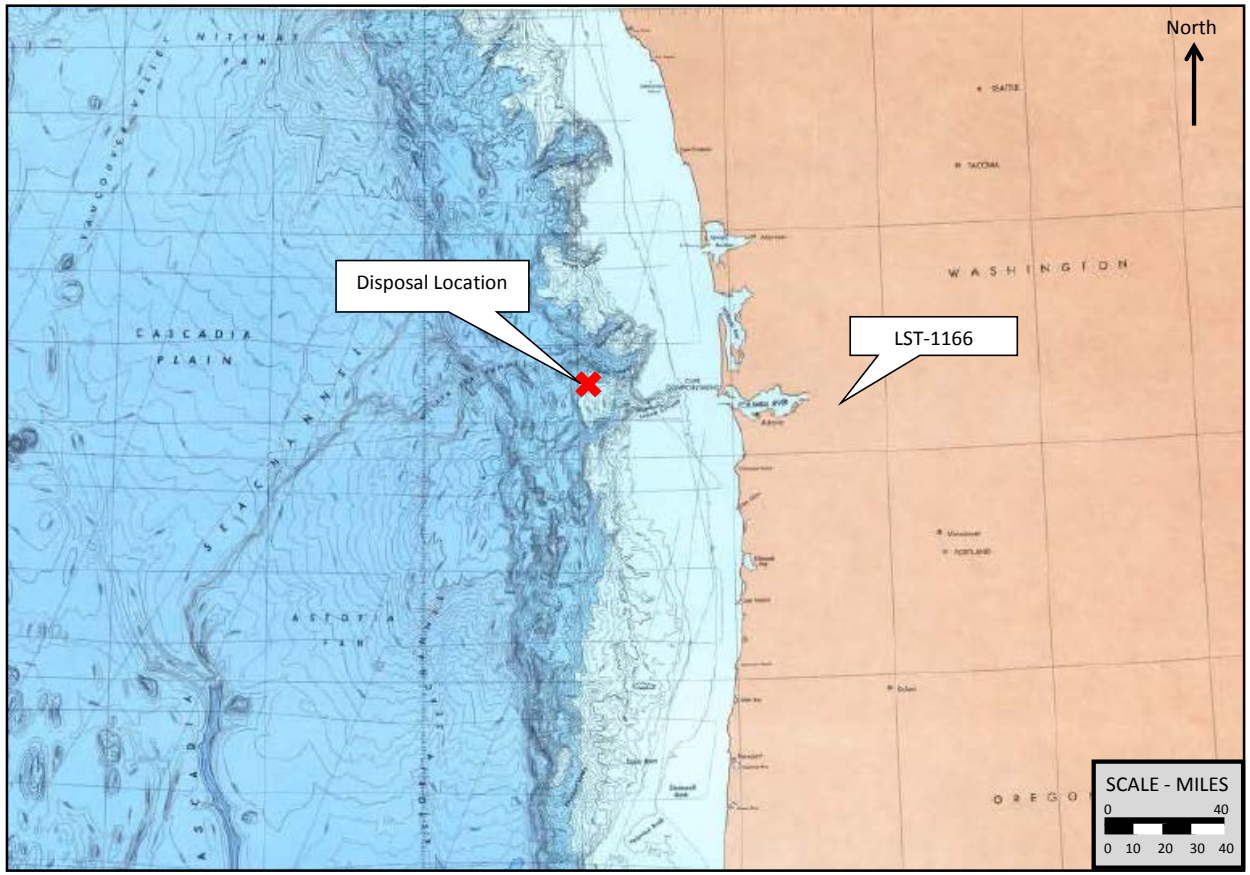


Figure 2: Disposal Location Map



APPENDIX A

A.1 Cost Estimates

Cost estimates were prepared for each of the three removal alternatives; 1) Ocean Disposal with Limited Decontamination, 2) Ocean Disposal with Full Decontamination, and 3) Decontamination, Dismantling Recycling and Disposal. The accuracy of the estimates may vary because details may change when the removal action is designed.

The general and specific assumptions used to generate the cost estimates are presented herein. The cost estimate tables; including quantities, unit costs, contingencies, overhead, profit, permitting and health and safety for the site are presented in Tables 1 through 3. Specific line item assumptions are also included within these tables. The costs presented in these tables are estimated based on vendor quotes, RS Means, professional experience and/or the assumptions stated. RS Means' 2004 Environmental Remediation Cost Data – Unit Price and RS Means' 2004 Environmental Remediation Cost Data – Assemblies were used for certain unit costs estimates as indicated. Costs have been escalated from 2004 to 2011 using a 2.7% inflation rate, based upon the rates published in Appendix C of Circular A-94 Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (United States Office of Management and Budget 2009).

Since the anticipated time frames for all three alternatives is less than 12 months and on-going operations and maintenance costs are not applicable to the removal alternatives, Present Worth costs were not calculated and Capital Costs were used as the basis for estimating total costs and in alternatives comparison.

Due to the limited information/documentation on the LST 1166, a contingency allowance of 20% was utilized for each alternative. Costs assume a health and safety personal protective equipment level (PPE) of modified D except where contaminant specific procedures require more stringent protection.

For certain cost estimate line items, an additional contingency (usually 100%) is applied for activities that require complicated access issues.

The following sections present the assumptions used for each alternative.

A.1.1 Alternative 1: Ocean Disposal with Limited Decontamination

The following general assumptions were used to generate a cost estimate for Alternative 1:

- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste
- Removal and disposal of approximately 600 pounds of friable paint chips

- Removal and disposal of approximately 400,000 pounds of foam
    - Non-hazardous disposal
- Removal and treatment of 500,000 gallons of non-oily water
    - Pumped through a carbon filter and discharged back into the river
- Securing equipment on-board the vessel
- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull
- Towing and scuttling of the vessel 65 nautical miles from the mouth of the Columbia River

Additional descriptions and assumptions for specific lines items are included in Table 1.

A.1.2 Alternative 2: Ocean Disposal with Full Decontamination

The following general assumptions were used to generate a cost estimate for Alternative 2:

- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste
- Removal and disposal of approximately 600 pounds of friable paint chips
- Removal and disposal of approximately 400,000 pounds of foam
    - Non-hazardous disposal
- Removal and treatment of 500,000 gallons of non-oily water
    - Pumped through a carbon filter and discharged back into the river
- Removal and disposal of polychlorinated biphenyls (PCB) paint from an area measuring approximately 12,000 square feet
- Securing equipment on-board the vessel
- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull
- Towing and scuttling of the vessel 65 nautical miles from the mouth of the Columbia River

Additional descriptions and assumptions for specific lines items are included in Table 2.

A.1.3 Alternative 3: Decontamination, Dismantling, Recycling and Disposal

The following general assumptions were used to generate a cost estimate for Alternative 3:

- Removal and treatment of approximately 500,000 gallons of non-oily water
    - Pumped through a carbon filter and discharged back into the river

After the above removal actions are completed, the vessel will prepared for transport and dry docking including:

- Securing equipment on-board the vessel
- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull

The vessel will be then towed using tugs to a dry dock located in the Portland area. At the dry dock the following activities will be completed:

- Removal and disposal of approximately linear 60 pounds of electrical wiring.
- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste
- Removal and disposal of PCB paint from an area measuring approximately 12,000 square feet
- Removal and disposal of approximately 1,000,000 pounds of foam
    - Non-hazardous disposal

This estimate also assumes that the dry dock period will be three months. A substantial cost savings for recycling steel is included in this cost estimate. Additional descriptions and assumptions for specific lines items are included in Table 3.

A.2 Cost Estimate Tables